Could the San Juan Islands National Wildlife Refuge Serve as a Marine Protected Area Network?

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Abstract

The San Juan Islands National Wildlife Refuge comprises 83 small islands and rocks scattered throughout the San Juan Archipelago in Washington State. Current guidelines set by USFWS advise vessels to stay 200 yards offshore from refuge sites to provide a marine buffer for birds and marine mammals who utilize the refuge. Compliance with the existing guidelines provides inherent protection to the intertidal and subtidal resources within these marine buffer zones and could arguably constitute a de facto network of (Marine Protected Areas (MPA) in the region. A two-part study was undertaken to evaluate nearshore buffer zones in the NWR relative to their function as MPAs. The first part examined biological and physical attributes of buffer zones to quantify potential contribution to marine protection in the region, using existing data to classify marine habitats within buffer zones. The second part reviewed institutions and legal authorities that could potentially bolster protection and management to marine areas of the NWR. Two major conclusions were derived from the study. One, the NWR is capable of serving as a viable network of MPAs contributing to regional resource protection. Two, success of the MPA will likely depend on the formation of partnerships between a variety of agencies and institutions.

Extended Abstract

Introduction

The San Juan Islands National Wildlife Refuge (San Juan NWR) is located within the San Juan Archipelago, at the convergence of the Strait of Juan de Fuca and the Straight of Georgia, in the inland waters of Washington State. The refuge consists of 83 small islands, rocks, and reefs scattered throughout the region, totaling 449 terrestrial acres (Murray 1998). Establishment of the San Juan NWR began in 1914, for the primary purpose of providing protection to migratory birds. Management of the refuge is today administered by the U.S. Fish and Wildlife Service (USFWS). Guidelines set by USFWS advise vessels to stay 200 yards offshore from all but two of the refuge sites to provide a marine buffer for marine birds, marine mammals, and endangered species who utilize the refuge (Murray 1998). Compliance with the existing guidelines provides protection not only to the terrestrial resources, but also to the intertidal and subtidal resources found within these marine buffer zones. Using the San Juan NWR as a foundation may provide a politically feasible means for establishing a marine protected area (MPA) network within the region without requesting that the public set aside new areas from public use.

Although a seemingly good opportunity for establishment of an MPA network, the biological attributes of such a system had not been ascertained or evaluated, nor had mechanisms been considered for bolstering management and protection to the marine areas surrounding upland refuge sites. In order to address these gaps, I conducted a two part study in which to evaluate the nearshore buffer zones of the San Juan NWR relative to their function as an MPA network: (1) a biological inquiry into the nearshore buffer zones, and (2) an institutional review of the refuge and surrounding marine waters.

Biological Inquiry

I used existing biological, physical, and geological data to ascertain attributes of nearshore buffers in order to quantify their potential contribution to marine protection in the region. Attributes of the nearshore buffer zones were analyzed in regards to adequacy of the refuge to preserve representative and unique marine habitats, essential ecological processes, and populations of interest in the region. These criteria were chosen to achieve an MPA network that would conserve and restore marine biodiversity so as "to maintain species diversity and the natural balance of species interactions" (NRC 2001), and to conserve the integrity of marine habitats. The protection fostered by such a network would help to "ensure the conservation of diverse species assemblages and maintain genetic diversity" as well as maintain "the full range of habitat types . . . necessary for food and shelter to support different stages in the life histories" of marine organisms (NRC 2001).

Habitat

My analysis of nearshore attributes was based largely on habitat mapping, conducted using a geographic information system (GIS). I used habitat in my analysis due to the lack of comprehensive biological data available for most of the refuge nearshore buffer zones. Habitat has been recognized as a convenient and effective proxy to infer living marine resources and processes likely to occur in geographic areas where data are sparse (Dethier 1990; NRC 2001; Ward *et al.* 1999).

I used a marine habitat classification system developed for the State of Washington (Dethier 1990), which is based on five physical characteristics: system (marine or estuarine), subsystem (intertidal or subtidal), substrate, energy level, and depth. This classification scheme was developed for a biogeographic region that includes the San Juan Archipelago and has the added benefit of providing habitat descriptions, lists of diagnostic species, and lists of commonly associated species for exemplary marine and estuarine habitats within the State of Washington. In effect, if habitat type for a specific marine area can be determined using the five physical characteristics of the Washington classification system (Dethier 1990), the classification system can then be used to provide biological attributes typical of that particular type of habitat. This enables a more comprehensive look at how these areas may be able to contribute to conservation and restoration of marine biodiversity and therefore their potential to serve as MPAs.

Data sources for habitat mapping included the ShoreZone Inventory, National Wetlands Inventory, and NOAA Nautical Charts. No new data were collected for the study. Confidence in habitat classification of nearshore buffer zones decreased with depth.

From the habitat mapping, I was able to determine habitat for 54 of the 83 San Juan NWR nearshore buffer zones. The refuge was determined to represent 22 types of habitat. Since I was unable to determine habitat for 29 of the nearshore buffer zones, I estimate that the actual number lies somewhere between 22 and 33 types of habitat represented. Of the 22 habitat types that were represented within the San Juan NWR, 11 were found to have low representation, which I deemed as four or fewer replications. Eight intertidal habitat types documented in San Juan County were not represented in the San Juan NWR. Corresponding measures for subtidal habitats within San Juan County could not be determined. I concluded that marine subtidal habitats were the most adequately represented habitat within the San Juan NWR. Estuarine habitats were concluded to be under- and less-adequately represented within the refuge; however this may be a reflection of low frequency of estuarine habitats in the San Juan Archipelago.

Priority Species and Other Species of Interest in the Region

In addition to habitat mapping, my analysis also utilized distribution mapping of priority species and other species of interest in the region. My intent was to determine whether nearshore buffer zones of the San Juan NWR were capable of capturing components of species' distribution in the region.

Priority species are defined by Washington Department of Fish and Wildlife (WDFW) as: (1) state listed candidate species, (2) vulnerable aggregations, or (3) species of recreational, commercial, and/or tribal importance that are vulnerable. Only priority species present within San Juan County were mapped.

I used data from the Marine Resources Database (administered by WDFW) for mapping priority species distributions. The majority of data in the Marine Resources Database were published prior to 1992. Although somewhat outdated, the data can still indicate whether San Juan NWR nearshore buffer zones are capable of capturing priority species distributions within the region.

In all, 12 priority species within San Juan County were mapped. Of the 12 species, the following were determined to occur within nearshore buffer zones of the San Juan NWR:
- Abalone
- Subtidal clams
- Dungeness crab
- Water-column dwelling shrimp
- Red and green sea urchins

The following species were present within San Juan County, but were not identified within nearshore buffer zones:
- Intertidal hard shelled clams
- Geoduck
- Pre-spawning holding areas of herring

- Herring spawning grounds (updated 12/2001)
- Oysters (Pacific and native. Despite these data, oysters most likely do exist within nearshore buffer zones)
- Sand lance spawning beaches (updated 01/2000)
- Sand smelt spawning beaches (updated 01/2000)

Although not all of the priority species present within San Juan County were found to be represented within the San Juan NWR, results from the mapping suggest that nearshore buffer zones could provide protection to a substantial fraction of priority species, leading to finer scale management for some priority species in Washington State.

In addition to mapping Washington State priority species, a variety of marine species assemblages of special interest in the region were mapped using data from the ShoreZone Inventory to provide greater insight into the attributes of San Juan NWR nearshore buffer zones.

Ten species assemblages of interest were mapped. The number of refuge sites found to overlap with each species assemblage is summarized in the following table:

Table 1. Number of San Juan NWR buffer zones in which each species assemblage is represented.

Species Assemblage (Bio-Band)	No. of NWR Sites
Upper barnacle	54
Blue mussel	2
Fucus	51
Mussel-barnacle	2
Nereocystis	40
Mixed filamentous & foliose red algae	26
Laminaria spp.	42
Surfgrass	10
Ulvoids	42
Zostera	15

Mapping was also conducted for two introduced (non-native) species:

Table 2. Number of San Juan NWR buffer zones in which each introduced species is present.

Species Assemblage (Bio-Band)	No. of NWR Sites
Oysters (*Crassosterea gigas*)	3
Sargassum	34

San Juan NWR nearshore buffer zones appear to adequately represent a number of species of interest within the region. Mapping of introduced species suggest that some nearshore buffers are host to non-native species. Special management may be required at such sites to prevent the invasion and spread of species that are particularly ecologically disruptive.

Institutional Review

Establishment of effective MPAs requires both social and scientific inputs (Gubbay 1995; NRC 2001). In order to provide a more comprehensive evaluation of the San Juan NWR nearshore buffer zones I included an institutional review of the refuge and surrounding marine buffer zones.

I began with a review of the existing management's authority over marine areas surrounding refuge sites. USFWS authority currently extends over lands designated as refuge and wilderness areas out to the mean high tide line (USFWS 1976). This means that the 200 yard "no entry" buffer zones surrounding refuge sites are strictly voluntary. In order to build an effective MPA network from the existing San Juan NWR, better management and enforcement of the marine areas will be needed. How then can the greatest protection be provided to the resources?

In the United States, management of marine resources and the marine system is typically divided between multiple entities at varying levels of government (e.g. federal, state, and local agencies) leading to a highly fragmented management regime for our oceans and coasts (Fiorino 1995). High fragmentation proves difficult for implementing management schemes geared towards ecosystems. To overcome fragmentation so as to provide comprehensive, ecosystem based management, MPA establishment will often require formation of partnerships between agencies and other institutions capable of providing management, monitoring, enforcement, and education/outreach.

Opportunities for Partnerships
I provided a review of institutions and legal authorities that could foster management, monitoring, enforcement, and education/outreach to the marine component of the Refuge and thereby provide increased protection to the living resources found within nearshore buffer zones. The following table provides a summary of potential partners and types of partnerships that could be forged in regards to the San Juan NWR nearshore buffer zones:

Table 3. Potential Partners and Types of Partnerships.

Partner	Type of Partnership
WA Dept. of Natural Resources	Management
WA Dept. of Fish & Wildlife	Management, monitoring, enforcement
Treaty Tribes	Management, monitoring, data collection
National Marine Fisheries Service	Monitoring and enforcement
U.S. Coast Guard	Monitoring and enforcement
The Whale Museum	Education/outreach, monitoring, data collection
San Juan County Board of County Commissioners and Marine Resources Committee	Education/outreach

There is precedent for formulating similar types of partnerships at other National Wildlife Refuge sites located within the State of Washington.

Conclusions and Recommendations

From my biological inquiry, I concluded that the San Juan NWR nearshore buffer zones are capable of contributing to marine resource protection in the region. Substantial protection may be afforded to dominant marine subtidal habitats and additional protection provided to various priority species and populations of interest in the region.

From my institutional review, I concluded that current management and protection of the marine areas surrounding refuge sites is, at this time, inadequate to constitute a *de facto* MPA network and that implementation and success of an MPA network would depend heavily upon the creation of partnerships with other existing agencies and institutions. There are a variety of opportunities and alternatives available for partnerships that could help ensure the success of the San Juan NWR as a network of MPAs in the San Juan Archipelago.

I recognize that implementing all 83 nearshore buffer zones of the refuge, as MPA sites, may be politically unfeasible. Therefore I recommend establishment efforts begin at a smaller scale by focusing on a group of pilot sites. For scientific purposes, at least three sites will need to be established, and preferably five or more sites would be established. I identified 13 San Juan NWR sites that I would recommend as pilot sites, based on the following criteria: (1) Habitats classified at site are likely to contain a high diversity of species or are likely to be highly productive. (2) Location of site. Site can readily be distinguishable from non-refuge sites, such as other small islands and rocks in the vicinity, and are not subject to regular heavy boat traffic. (3) Site provides opportunity for education and outreach.

This study has explored how taking advantage of opportunities to create an MPA network from an existing and recognized refuge system, and building upon the existing management, may have merit for establishing a successful and functioning MPA network. I believe that the San Juan NWR provides a great opportunity for the successful establishment of an MPA network in the San Juan Archipelago region.

Acknowledgements

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